

Warren A. Iquist Act, Section 25402

- The Energy Commission is required by law to develop and maintain energy efficiency standards that are “. . . cost effective, when taken in their entirety, and when amortized over the economic life of the structure when compared with historic practice”.

California Energy Efficiency Standards 2005



Two Methods

- Annual LCC Method

- Previous energy efficiency standards have been shown to be cost effective using an *Annual LCC Method*.
- The net present value (NPV) of the savings is calculated by multiplying the annual savings by the present value of a unit of saved energy

- Hourly LCC Method

- Time Dependent Valuation (TDV) is a recommended standards change for the 2005 standards. Using TDV requires a more advanced approach to LCC that may be used as an option.

California Energy Efficiency Standards 2005



Likely Winners and Losers

Winners	Losers	No Change
Peak Air Conditioning Fenestration (more directional) Gas Cooling Cool Roofs Other On-Peak	Propane (smaller advantage over electricity) Economizers Other Off-Peak	Insulation Residential Water Heating

California Energy Efficiency Standards 2005

The Annual Method

The key points of the annual LCC methodology are as follows:

1. If a measure reduces overall life cycle cost, then it is cost effective. It is not necessary (or even desirable) to calculate absolute life cycle cost.
2. The change in life cycle cost between two measures is calculated as follows:

$$\begin{array}{rclclcl} \text{Change in} & & = & \text{Change in} & - & \text{Present Value of} & - & \text{Present Value of Gas} \\ \text{Life cycle Cost} & & & \text{Initial Cost} & & \text{Electricity Cost} & & \text{Cost Savings} \\ & & & & & \text{Savings} & & \end{array}$$

3. The present value of electricity and gas cost savings is calculated as follows:

$$\begin{array}{rclcl} \text{Present Value of} & = & \text{Energy} & \times & \text{Present value per unit} \\ \text{Energy Cost Savings} & & \text{Saved Per} & & \text{of energy saved over} \\ & & \text{Year} & & \text{the life of the measure} \\ \\ (\$) & & (\text{kWh/y}) & & (\$/(\text{kWh/y})) & \text{Electricity units} \\ (\$) & & (\text{therms}) & & (\$/\text{therm}) & \text{Gas units} \end{array}$$

Economic Assumptions

- Future energy savings are discounted to present value at the rate of 3%.
- For nonresidential lighting and HVAC measures, energy savings are considered over a period of 15 years.
- A 30-year time horizon is used for all low-rise residential measures and nonresidential envelope measures.
- Price projections for electricity and natural gas are taken from the CEC forecasting group.

California Energy Efficiency Standards 2005



Present Value of Electricity and Gas

	Electricity \$/kWh-y		Natural Gas \$/therms-y	
Time Horizon	Res	Nonres	Res	Nonres
30 Years	2.06	2.10	14.21	12.64
15 Years	N.A.	1.37	N.A.	7.30

California Energy Efficiency Standards 2005

Range of Present Value Estimates

Estimate	Time Horizon	Present Value of a kWh of Electricity Saved Over the Building Life			Present Value of a Therm of Gas Saved Over the Building Life	
		Residential	Small	Medium	Residential	Nonresidential
Current CEC Statewide Averages	15 Years	N.A.	N.A.	\$1.37	\$8.32	\$7.30
	30 Years	\$2.06	N.A.	\$2.10	\$14.21	\$12.64
1992 Standards	15 Years	N. A[gwp1].	\$1.04		N. A.	\$6.47
	30 Years	\$1.95	N. A.	N. A.	\$14.08	N. A.
AB 970 Standards	15 Years	1.27	\$1.31	\$1.02	\$8.20	\$7.04
	30 Years	2.07	\$2.15	\$1.68	\$13.27	\$11.43
AB 970 CEC Time Block Weighted[gwp2]	15 Years	N. A.	\$1.35	\$1.03	N. A.	N. A.
	30 Years	N. A.	\$2.17	\$1.66	N. A.	N. A.
AB 970 CPUC Time Block Weighted[gwp3]	15 Years	N. A.	\$1.79	\$1.59	N. A.	N. A.
	30 Years	N. A.	\$2.74	\$2.39	N. A.	N. A.
ASHRAE/IESNA Standard 90.1-1999	15 Years	N. A.	\$0.64		N. A.	\$4.48
	30 Years	N. A.			N. A.	
PG&E Time Dependent Valuation (TDV[gwp4])	15 Years	N. A.	≈ \$1.35		N. A.	\$8.60
	30 Years	\$2.50	N. A.	N. A.	\$18.60	N. A.

Note: Life cycle cost for the 2001 (AB 970) changes were based on statewide averages. Values used are shown bold faced.

Hourly LCC Method

- Time Dependent Valuation (TDV) accounts for time-of-use in determining cost effectiveness.
- TDV is based on a time series of hourly present values for electricity, natural gas and propane.
- Values have been developed for both residential and nonresidential buildings and for all 16 climate zones.
- The present value numbers for nonresidential buildings are based on 15-year projections while the present value numbers for low-rise residential buildings are based on 30-year projections.

Statistical Summary of TDV Present Values

		Electricity (\$/kWh)		Gas (\$/therm)		Propane (\$/therm)	
		Commercial	Residential	Commercial	Residential	Commercial	Residential
CZ1	Average	\$1.26	\$1.83	\$8.04	\$13.74	\$13.65	\$25.00
	Minimum	\$0.66	\$0.98	\$7.38	\$12.61	\$12.30	\$22.70
	Maximum	\$5.05	\$7.61	\$8.88	\$15.17	\$14.79	\$26.92
	Stand. Dev.	\$0.42	\$0.63	\$0.42	\$0.72	\$0.84	\$1.42
CZ2	Average	\$1.26	\$1.83	\$8.04	\$13.74	\$13.65	\$25.00
	Minimum	\$0.66	\$0.98	\$7.38	\$12.61	\$12.30	\$22.70
	Maximum	\$5.24	\$7.94	\$8.88	\$15.17	\$14.79	\$26.92
	Stand. Dev.	\$0.44	\$0.67	\$0.42	\$0.72	\$0.84	\$1.42
CZ3	Average	\$1.26	\$1.84	\$8.04	\$13.74	\$13.65	\$25.00
	Minimum	\$0.66	\$0.99	\$7.38	\$12.61	\$12.30	\$22.70
	Maximum	\$5.74	\$8.92	\$8.88	\$15.17	\$14.79	\$26.92
	Stand. Dev.	\$0.45	\$0.69	\$0.42	\$0.72	\$0.84	\$1.42
CZ4	Average	\$1.26	\$1.83	\$8.04	\$13.74	\$13.65	\$25.00
	Minimum	\$0.66	\$0.99	\$7.38	\$12.61	\$12.30	\$22.70
	Maximum	\$7.83	\$12.19	\$8.88	\$15.17	\$14.79	\$26.92
	Stand. Dev.	\$0.50	\$0.77	\$0.42	\$0.72	\$0.84	\$1.42

Statistical Summary of TDV Present Values

		Electricity (\$/kWh)		Gas (\$/therm)		Propane (\$/therm)	
		Commercial	Residential	Commercial	Residential	Commercial	Residential
CZ5	Average	\$1.26	\$1.84	\$8.04	\$13.74	\$13.65	\$25.00
	Minimum	\$0.66	\$0.99	\$7.38	\$12.61	\$12.30	\$22.70
	Maximum	\$6.49	\$10.23	\$8.88	\$15.17	\$14.79	\$26.92
	Stand. Dev.	\$0.47	\$0.73	\$0.42	\$0.72	\$0.84	\$1.42
CZ6	Average	\$1.42	\$2.02	\$7.05	\$15.22	\$13.65	\$25.00
	Minimum	\$0.67	\$0.90	\$6.53	\$14.11	\$12.30	\$22.70
	Maximum	\$4.95	\$7.53	\$7.77	\$16.78	\$14.79	\$26.92
	Stand. Dev.	\$0.47	\$0.72	\$0.41	\$0.89	\$0.84	\$1.42
CZ7	Average	\$1.30	\$2.04	\$8.20	\$15.36	\$13.65	\$25.00
	Minimum	\$0.66	\$1.10	\$7.01	\$13.12	\$12.30	\$22.70
	Maximum	\$4.74	\$7.32	\$9.07	\$16.98	\$14.79	\$26.92
	Stand. Dev.	\$0.44	\$0.66	\$0.57	\$1.07	\$0.84	\$1.42
CZ8	Average	\$1.42	\$2.01	\$7.05	\$15.22	\$13.65	\$25.00
	Minimum	\$0.67	\$0.89	\$6.53	\$14.11	\$12.30	\$22.70
	Maximum	\$6.00	\$9.17	\$7.77	\$16.78	\$14.79	\$26.92
	Stand. Dev.	\$0.51	\$0.79	\$0.41	\$0.89	\$0.84	\$1.42

Statistical Summary of TDV Present Values

		Electricity (\$/kWh)		Gas (\$/therm)		Propane (\$/therm)	
		Commercial	Residential	Commercial	Residential	Commercial	Residential
CZ9	Average	\$1.42	\$2.00	\$7.05	\$15.22	\$13.65	\$25.00
	Minimum	\$0.67	\$0.88	\$6.53	\$14.11	\$12.30	\$22.70
	Maximum	\$7.04	\$10.96	\$7.77	\$16.78	\$14.79	\$26.92
	Stand. Dev.	\$0.55	\$0.86	\$0.41	\$0.89	\$0.84	\$1.42
CZ10	Average	\$1.42	\$2.00	\$7.05	\$15.22	\$13.65	\$25.00
	Minimum	\$0.67	\$0.88	\$6.53	\$14.11	\$12.30	\$22.70
	Maximum	\$5.99	\$9.11	\$7.77	\$16.78	\$14.79	\$26.92
	Stand. Dev.	\$0.51	\$0.79	\$0.41	\$0.89	\$0.84	\$1.42
CZ11	Average	\$1.26	\$1.82	\$8.04	\$13.74	\$13.65	\$25.00
	Minimum	\$0.66	\$0.98	\$7.38	\$12.61	\$12.30	\$22.70
	Maximum	\$4.83	\$7.25	\$8.88	\$15.17	\$14.79	\$26.92
	Stand. Dev.	\$0.43	\$0.65	\$0.42	\$0.72	\$0.84	\$1.42
CZ12	Average	\$1.26	\$1.83	\$8.04	\$13.74	\$13.65	\$25.00
	Minimum	\$0.66	\$0.98	\$7.38	\$12.61	\$12.30	\$22.70
	Maximum	\$6.18	\$9.46	\$8.88	\$15.17	\$14.79	\$26.92
	Stand. Dev.	\$0.47	\$0.72	\$0.42	\$0.72	\$0.84	\$1.42

Statistical Summary of TDV Present Values

		Electricity (\$/kWh)		Gas (\$/therm)		Propane (\$/therm)	
		Commercial	Residential	Commercial	Residential	Commercial	Residential
CZ13	Average	\$1.26	\$1.82	\$8.04	\$13.74	\$13.65	\$25.00
	Minimum	\$0.66	\$0.97	\$7.38	\$12.61	\$12.30	\$22.70
	Maximum	\$4.66	\$6.97	\$8.88	\$15.17	\$14.79	\$26.92
	Stand. Dev.	\$0.41	\$0.62	\$0.42	\$0.72	\$0.84	\$1.42
CZ14	Average	\$1.42	\$2.00	\$7.05	\$15.22	\$13.65	\$25.00
	Minimum	\$0.67	\$0.88	\$6.53	\$14.11	\$12.30	\$22.70
	Maximum	\$5.41	\$8.16	\$7.77	\$16.78	\$14.79	\$26.92
	Stand. Dev.	\$0.49	\$0.75	\$0.41	\$0.89	\$0.84	\$1.42
CZ15	Average	\$1.42	\$1.99	\$7.05	\$15.22	\$13.65	\$25.00
	Minimum	\$0.67	\$0.87	\$6.53	\$14.11	\$12.30	\$22.70
	Maximum	\$5.51	\$8.31	\$7.77	\$16.78	\$14.79	\$26.92
	Stand. Dev.	\$0.49	\$0.76	\$0.41	\$0.89	\$0.84	\$1.42
CZ16	Average	\$1.26	\$1.83	\$8.04	\$13.74	\$13.65	\$25.00
	Minimum	\$0.66	\$0.98	\$7.38	\$12.61	\$12.30	\$22.70
	Maximum	\$5.31	\$8.03	\$8.88	\$15.17	\$14.79	\$26.92
	Stand. Dev.	\$0.43	\$0.64	\$0.42	\$0.72	\$0.84	\$1.42